Video
FULL DETAILS AND TRANSCRIPT

Research-Based Instructional Programs

Lynn S. Fuchs, Ph.D. • June 2008

Topic: National Math Panel: Critical Foundations for Algebra
Practice: Mastery Framework

Highlights

- In-depth discussion of important instructional features
- Importance of providing clear and precise explanations at the beginning of a topic and examples of how to do this
- Explanation and examples of how to design instruction for efficient learning, including approaches to teaching students how to solve word problems
- Importance of providing conceptually rich instruction, including multiple representations, concrete manipulatives, pictorial representations, etc.
- Essential role of drill and practice in developing fluency
- Why cumulative review is important
- The need for instruction that motivates students

About the Interviewee

Lynn S. Fuchs is the Nicholas Hobbs Professor of Special Education and Human Development at Vanderbilt University, where she also co-directs the Kennedy Center Reading Clinic. She has conducted programmatic research on assessment methods for enhancing instructional planning and on instructional methods for improving reading and math outcomes for students with learning disabilities. Dr.

Fuchs has published more than 200 empirical studies in peer-review journals. She sits on the editorial boards of 10 journals including the *Journal of Educational Psychology, Scientific Studies of Reading, Elementary School Journal*, *Journal of Learning Disabilities*, and *Exceptional Children*. She been identified by Thompson ISI as one of 250 "most highly cited" researchers in the social sciences, and has received a variety of awards to acknowledge her research accomplishments that have enhanced reading and math outcomes for children with and without disabilities. Her awards include the Council for Exceptional Children's Career Research Award; Vanderbilt University's Joe B. Wyatt Distinguished University Professor; Vanderbilt's Earl Sutherland Award for Research Accomplishments; the American Education Research Association's Distinguished Researcher Award from the Special Education Research SIG; the 2001 Article of the Year Award for best article in the 2000 volume year in School Psychology Review; the 2000 Council for Exceptional Children/ Division of Learning Disabilities Samuel A. Kirk Award for the exemplary practice article from the 1998 volume of Learning Disabilities Research and Practice; the 2000 Alumni Distinguished Faculty Scholar Award, awarded by the Peabody Alumni Board of Vanderbilt University; the 1998 American Educational Research Association's Palmer O. Johnson Award for the outstanding article appearing in an AERA-sponsored journal for the 1997 volume year; the 1998: Mayor's Educator of the Year Award (Nashville, TN); the 1997 Learned Article Award from the Educational Press Association; and the 1996 School Psychology Quarterly/American Psychological Association Division 16 Fellows Award for Best Articles.

Full Transcript

My name is Lynn Fuchs. I am the Nicholas Hobbs Professor of Special Education and Human Development at Vanderbilt University.

Over the past 25 years, I have been working with my colleagues to develop effective classroom practices in the areas of math and reading. So, what we are trying to do in a general way is identify, validate effective practices, understand the child characteristics that are associated with better and less good response to those validated practices, and then look at ways that we can tailor instruction to children who are having difficulty.

When we develop our instructional packages, we are generally trying to incorporate a set of instructional principles. The first instructional principle is explicitness. So, in the work that we do, we incorporate clear, precise explanations for children at the beginning of a topic. So, right from the very beginning, teachers are explaining to the children the conceptual basis for the topic that's being addressed, showing worked examples—and by worked examples, I mean problems that are already solved, where the teacher explains the steps that led to the solution and why the steps work. So, we are addressing both the conceptual and the procedural aspects of the content that's being taught. And, gradually, the teacher goes from using worked examples to only partially completed examples. As the children take over the responsibility, they also take over the responsibility of explaining what they are doing and why what they are doing is working.

Instructional design for efficient learning is the second design feature that we use in our instruction. Most recently, we have been working in the area of math problem solving. And when we work in math problem solving, we begin by making sure that children have all the foundational skills they need, so when we get to the word problems, they can call upon the foundational skills we know they have. So we teach them efficient strategies, counting strategies for deriving answers to simple math facts. We make sure that their understanding and their accuracy in doing procedural calculation is strong. Even children as young as second and third grade, we teach them how to solve simple algebraic equations, and we also teach them the foundational skill of checking work. So they are firm on when they have an answer, they know they have to decide whether their answer makes sense, whether the numbers that they have used they've pulled out of the word problem are aligned correctly, whether they have done the calculation in the problem correctly, whether their answer is labeled correctly with any words or money signs or anything else that needs to be done.

When we get to the word problem instruction, we also design the instruction with efficiency in mind, and so, for example, we teach problem types. So children learn how to do problems that we call "total problems," where children are combining sets, and children are taught that this is a problem type. And they are taught that a combining or totalling problem type is different from what we call a difference problem type, where problems are comparing two different numbers or two different quantities. We teach children a variety of problem types. And the way this creates efficiency is that the children are taught that the first time they see a problem, they read it, they underline the question, and they name the problem type. So when they get to a novel problem that they have never seen before, they can make their solution strategies efficient by first categorizing that problem as a problem type for which they know a solution. We also teach the children to transfer. We teach them about irrelevant information in word problems. We teach them about how some problems look different because some of the information you need to find—you need to solve a problem—is found in charts or graphs. So we teach them different ways that problems will look novel, but they can recognize those novel-looking problems as belonging to a problem type for which they do know a solution.

The third design feature that we use when we are designing programs is to make sure that the instruction is conceptually rich so that children are understanding why they are solving problems in particular ways. And we always try to rely on multiple representations, which is one of the research principles cited in the Panel's report, so that we help children understand the conceptual basis for the math that they are doing by relying on role playing by using concrete manipulatives—and different kinds of concrete manipulatives—by using a variety of pictorial representations and even by having children generate problems themselves to fit a certain conceptual problem type within the area of math.

And the fourth instructional design feature is drill and practice. We believe that it is important for children to be fluent in certain foundational skills so they can use those foundational skills with ease as they are applying those skills to complex math content. Another instructional design feature we incorporate in our work is cumulative review so that children are always comparing the new thing they are learning to older

things they have already learned to identify the key differences and similarities between what they are learning now and what they have previously learned. And by making sure that as we are addressing new content, we are giving children a lot of opportunity to cumulatively practice what they have previously learned and mixing problem types together, so that when children are learning something new, at first, all the new problems are of the new problem type. But gradually we are interspersing old problems with the new problems so children have to distinguish different kinds of math problems from each other.

And then the last thing, which I think is especially important for children who are struggling with math, is to make sure that the instruction is motivating. Even a validated instructional practice is not going to be effective for all children and that's why we need ongoing formative assessment, to catch those children early so we can revise their programs as quick as we know that we need to and also to use the formative assessment data to actually experiment with how to strengthen the validated instructional program to make it specifically effective for this student who doesn't respond to the standard form of instruction.